Office Note
85-2

AFOS-ERA VERIFICATION OF GUIDANCE AND LOCAL AVIATION/PUBLIC WEATHER FORECASTS--NO. 2 (APRIL 1984-SEPTEMBER 1984)

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1. INTRODUCTION

This is the second in a new series of Techniques Development Laboratory (TDL) office notes which compare the performance of TDL's automated guidance with National Weather Service (NWS) local forecasts made at Weather Service Forecast Offices (WSFO's). All of the forecasts (both local and guidance) and the verifying observations were collected locally at the WSFO's, transmitted via the Automation of Field Operations and Services (AFOS) system to the National Meteorological Center, and archived centrally by TDL. The local collection system is described by Miller et al. (1984), while guidelines for the public/aviation forecast verification program are given in National Weather Service (1983a).

In this report, we present verification statistics for the warm season months of April through September 1984 for probability of precipitation (PoP), surface wind, cloud amount, ceiling height, visibility, and maximum/minimum (max/min) temperature. Verification summaries are provided for both forecast cycles, 0000 and 1200 GMT. The scores are those recommended in the NWS National Verification Plan (National Weather Service, 1982).

The local public weather PoP and max/min forecasts used for verification were official forecasts obtained from the Coded City Forecast (FPUS4) bulletin. All of the local aviation weather forecasts (except for cloud amount) were obtained from NWS official terminal forecasts (FT's). The local cloud amount forecasts were manually entered by the forecasters at the WSFO's. The local subjective forecasts may or may not be based on the objective guidance. Also, surface observations as late as 2 hours before the first valid forecast time may have been used in preparation of the local forecasts.

The automated guidance was based on forecast equations developed through application of the Model Output Statistics (MOS) technique (Glahn and Lowry, 1972). In particular, these prediction equations were derived by using archived surface observations and forecast fields from the Limited-area Fine Mesh (LFM) model (Gerrity, 1977; Newell and Deaven, 1981; National Weather Service, 1981b). The surface observations used in these equations were taken at least 9 hours before the first verification valid time.

As noted in the sections which follow for each of the various weather elements, implementation of the new AFOS-era verification system has introduced significant changes from past verifications in regard to the characteristics of the local forecasts and verifying observations. For example, the local and guidance max/min temperature forecasts are now being verified by using max/min temperatures observed during 12-h instead of 24-h (calendar day) periods. Also, the cloud amount observations are given in terms of total sky cover rather than opaque sky cover. Many other changes are associated with obtaining the local forecasts from the FT's. Hence, at this time, we do not think it is meaningful to compare results for the 1984 warm season with those for prior years which were based on the pre-AFOS verification system (e.g., Maglaras et al., 1984).

2. PROBABILITY OF PRECIPITATION

MOS PoP forecasts were produced by the warm season prediction equations described in Technical Procedures Bulletin No. 299 (National Weather Service, 1981a). This guidance was available for the first, second, and third periods, which correspond to 12-24, 24-36, and 36-48 hours, respectively, after 0000 and 1200 GMT. The predictors for the equation development were forecast fields from the LFM model and weather elements observed at the forecast site at 0300 or 1500 GMT. However, because of time constraints in day-to-day operations, surface observations at 0200 or 1400 GMT were used as input to the prediction equations about 50% of the time.

The forecasts were verified by computing Brier scores (Brier, 1950) for 93 of the 94 stations listed in Table 2.1. Please note that we used the standard NWS Brier score for PoP which is one-half the original score defined by Brier. Brier scores will vary from one station to the next and from one year to the next because of changes in the relative frequency of precipitation. In particular, the scores usually are better for periods of below normal precipitation. Therefore, we also computed the percent improvement over climate, that is, the percent improvement of Brier scores obtained from the local or guidance forecasts over analogous Brier scores produced by climatic forecasts. Climatic forecasts are defined as relative frequencies of precipitation by month and by station determined from a 15-yr sample (Jorgensen, 1967). Because local forecasters should be encouraged to depart from the guidance if they have reason to believe it is incorrect, the number of times local forecasters deviated from the guidance and the percent of these changes which were in the correct direction also were tabulated.

Tables 2.2 and 2.7 present the 1984 warm season results for all 93 stations combined for the 0000 and 1200 GMT cycle forecasts, respectively. Tables 2.3-2.6 and Tables 2.8-2.11 show scores for the NWS Eastern, Southern, Central, and Western Regions, for the 0000 and 1200 GMT cycles, respectively. Comparison of the Brier scores and improvements over climate in Table 2.2 indicates the 0000 GMT cycle local forecasts were better than the guidance for the first and second periods but worse for the third period. Local forecasters deviated from the guidance about 55% of the time and were correct when they did so 54%, 52%, and 49% of the time for the first, second, and third periods, respectively. On the regional level for the 0000 GMT cycle (Tables 2.3-2.6), the local forecasts for all regions and periods were as good as or better than the guidance except for the second-period forecasts for the Southern Region and the third-period forecasts for the Eastern, Southern, and Central Regions. Table 2.7 shows that, overall, the local forecasts were better than the guidance for the first period from 1200 GMT (2.8% improvement), but that the two sets of forecasts were about equal in skill for the second and third periods. Local forecasters deviated from the guidance about 55% of the time and were correct when they did so 55%, 48%, and 54% of the time for the first, second, and third periods, respectively. Except for the second-period forecasts for the Eastern and Southern Regions and the third-period forecasts for the Southern Region, the local forecasts for all regions and periods (Tables 2.8-2.11) were as good as or better than the guidance.

In terms of percent improvement over climate, the first- and third-period local and guidance forecasts for the 0000 GMT cycle were worse than those for the 1983 warm season (Maglaras et al., 1984), but the 1984 forecasts were better for the second period. For the 1200 GMT cycle, the 1984 forecasts were worse than those for the previous warm season for all three periods.

3. SURFACE WIND

The objective surface wind forecasts were generated by the warm season, LFM-based equations described in Technical Procedures Bulletin No. 335 (National Weather Service, 1983b). Prior to the 1984 warm season, the surface wind prediction equations were rederived in order to account for the most recent data available from the LFM model.

We verified the 12- and 18-h forecasts from both 0000 and 1200 GMT. The previous AFOS-era verification report (Carter et al., 1984) also contained statistics for 30-h guidance and local surface wind forecasts. However, in response to a recommendation from the National Verification Committee, the 30-h forecasts were replaced by 24-h forecasts during the middle of the 1984 warm season. Hence, for this report, we were not able to archive enough forecasts of either the 24- or 30-h projection to obtain a meaningful verification sample.

The objective surface wind forecast is defined in the same way as the observed wind, namely, the 1-min average wind direction and speed for a specific time. All objective forecasts of wind speed were adjusted by an "inflation" technique (Klein et al., 1959) involving the multiple correlation coefficient and the mean value of wind speed for each particular station and forecast valid time.

The local forecasts were obtained from the FT's. Since the FT's do not mention wind if the speed is expected to be less than 10 kt, the wind forecasts were verified in two ways. First, for those cases in which the speed forecasts from both the FT and MOS were $\geq$10 kt, the mean absolute error (MAE) and the mean algebraic error of the speed forecasts were computed. Cases where the observed wind was calm were then eliminated from this sample and the MAE of direction was computed. Second, for all cases where both the FT's and the MOS forecasts were available, skill score,[1] percent correct, bias by category,[2]

[1]The skill score used throughout this report is the Heidke skill score (Panofsky and Brier, 1965).

[2]In the discussion of surface wind, cloud amount, ceiling height, and visibility, bias by category refers to the number of forecasts of a particular category (event) divided by the number of observations of that category. A value of 1.0 denotes unbiased forecasts for a particular category.

and the threat score[3] were computed from contingency tables of wind speed. The definitions of the categories used in the contingency tables for wind speed and direction are given in Table 3.1. The threat score used here was calculated by combining events of the upper two categories. In addition, for all cases in which the wind speeds (forecasts or corresponding observations) were at least 10 kt, the skill score for the wind direction forecasts was computed from contingency tables. The 94 stations used in the verification are listed in Table 2.1.

It is important to note that several fundamental differences exist between the objective MOS forecasts and the local forecasts obtained from the FT's. In particular, the FT's are not as precise in regard to valid time as are the objective forecasts. Another point that needs to be considered is the nature of the wind forecast in the FT. It is unclear whether aviation forecasters tend to concentrate on a specific extreme wind or on an average wind over the forecast period. In this respect, an additional comparison was made between the objective and local forecasts by using the highest observed wind within ± 3 hours surrounding the verification time. Since the results were similar to those based on the single observation at the verification time, they are not presented here. Due to these and other possible differences between the MOS forecasts and local forecasts as obtained from the FT's, only conclusions of a general nature should be drawn from the verification statistics.

In addition, 42-h forecasts of winds ≥ 22 knots were collected as part of the AFOS-era verification system. The local forecasts were manually entered by forecasters at the WSFO's. However, the first warm season of this verification program did not result in a sufficient sample of 42-h forecasts for a meaningful comparative verification. We hope this situation will improve as the local forecasters become more familiar with the new system.

The results for all 93 (94) stations combined for the 0000 (1200) GMT cycles are presented in Tables 3.2-3.4 (Tables 3.9-3.11). The direction MAE's and skill scores for the 0000 and 1200 GMT cycles, as given in Tables 3.2 and 3.9, show that the local forecasters were superior to the guidance at the 12-h projection. In contrast, for the 18-h projection, the guidance was better than the locals and by a wider margin. The speed MAE's indicate that the locals were superior except for the 18-h projection after 1200 GMT where the MAE's for both the guidance and the locals were the same. The skill scores for speed show that the guidance had better skill scores except for the 12-h projection after 0000 GMT. For percent correct, the locals were slightly better than the guidance with the exception of the 18-h projection from 1200 GMT where the guidance had a slight advantage. In terms of the mean algebraic errors, the local forecasters were superior for all projections. The speed bias by category in Tables 3.2 and 3.9 and the contingency tables in Tables 3.4 and 3.11 show that for the 0000 GMT cycle, the guidance generally overestimated winds stronger than 17 kt (i.e., categories 3, 4, 5, and 6) for both projections. In contrast, the locals underestimated speeds in these same categories. The speed bias by category for the 1200 GMT cycle indicates the

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[3]Threat score = H/(F+O-H), where H is the number of correct forecasts of a category, and F and O are the number of forecasts and observations of that category, respectively.

the local forecasters underestimated wind speeds greater than 17 kt (i.e., categories 3, 4, 5, and 6). In terms of the threat score for categories 5 and 6 combined, the locals were superior to the guidance, except for the 18-h projection after 1200 GMT.

Tables 3.5-3.8 and 3.12-3.15 show scores for the NWS Eastern, Southern, Central, and Western Regions for 0000 and 1200 GMT, respectively. The regional comparisons have the same general characteristics as were noted for the entire group of stations. Of course, for some scores, the comparisons differ from region to region.

4. CLOUD AMOUNT

During the 1984 warm season, the objective cloud amount forecasts were produced by the prediction equations described in Technical Procedures Bulletin No. 303 (National Weather Service, 1981c). These regional, generalized-operator equations used LFM model output and 0300 (1500) GMT surface observations to produce probability forecasts of the four categories of cloud amount shown in Table 4.1. We converted the probability estimates to "best category" forecasts in a manner which produced good bias characteristics, that is, a bias value of approximately 1.0 for each category. The threshold technique described in Technical Procedures Bulletin No. 303 was used to obtain the best category.

We compared the local forecasts with a matched sample of guidance forecasts for 92 of the 94 stations listed in Table 2.1 for the 12-, 18-, and 24-h projections from 0000 and 1200 GMT. The local forecasts and surface observations used for verification were converted to the cloud amount categories given in Table 4.1. Four-category (clear, scattered, broken, and overcast), forecast-observed contingency tables were prepared from the local and objective categorical predictions. Using these tables, we computed the percent correct, skill score, and bias by category. In past verifications (except for the 1983-84 cool season), only opaque sky cover amounts from surface observations were used in determining the observed categories. However, the hourly surface reports from which the verifying observations are being taken do not include total opaque sky cover as part of the observation; hence, thin clouds are also taken into account. For example, a report of overcast with eight tenths opaque and two tenths thin which was put in the broken category previously, now is categorized as overcast. The result of this change is to decrease (increase) the number of observations of the broken (overcast) category compared to previous verifications. This change has greatly affected the overall bias by category statistics for the guidance and local forecasts.

The results for all stations combined are shown in Tables 4.2 and 4.7 for the 0000 and 1200 GMT cycle forecasts, respectively. In terms of skill score and percent correct, the 0000 GMT cycle local forecasts did better than the guidance for the 12-h projection; there was little difference at 18 hours, while MOS was better at 24 hours. Examination of the biases by category shows that the guidance forecasts were better (i.e., closer to 1.0) than the locals for seven out of the 12 possible projections and categories. The bias results for local and guidance forecasts were, in general, extremely poor. For the clear and scattered categories, the biases by category are about the same as for previous warm seasons. However, scores for the broken and overcast categories are much worse than in previous warm seasons for both the local and guidance forecasts; most likely, this was because of the changes in the verification process mentioned earlier. For 1200 GMT (Table 4.7), the local forecasts were better than the guidance in terms of skill score and percent correct for only the 12-h projection. Again, the biases by category show that the guidance was slightly better than the locals.

Tables 4.3-4.6 and Tables 4.8-4.11 show scores for the NWS Eastern, Southern, Central, and Western Regions, for the 0000 and 1200 GMT cycles, respectively. For both cycles, the comparisons varied from region to region and from score to score.

5. CEILING AND VISIBILITY

During the 1984 warm season, the ceiling and visibility guidance was produced by the prediction equations described in Technical Procedures Bulletin No. 303 (National Weather Service, 1981c). Operationally, the guidance was based primarily on LFM model output and 0300 (1500) GMT surface observations.

Verification scores were computed for both local and guidance forecasts for the stations listed in Table 2.1. The local forecasts were obtained from the FT's. Persistence based on an observation taken at 0900 (2100) GMT for the 0000 (1200) GMT forecast cycle was used as a standard of comparison. The objective forecasts were verified for both cycles for 12-, 18-, and 24-h projections. The local and persistence forecasts were verified for 12-, 15-, 18-, and 24-h projections from 0000 and 1200 GMT. On station, the guidance and persistence observations usually were available in time for preparation of the local forecasts. As was the case for surface wind, the local ceiling and visibility forecasts from the FT's are not given for a specific valid time. Hence, any comparisons with the results for the objective forecasts must be of a general nature.

We constructed forecast-observed contingency tables for the four categories of ceiling and visibility given in Table 5.1. These categories were used for computing several different scores: bias by category, percent correct, skill score, and log score.[4] We have summarized the results in Tables 5.2-5.5. It should be noted that the persistence and local forecasts for the 12-, 15-, 18-, and 24-h projections are actually 3-, 6-, 9-, and 15-h forecasts, respectively, from the latest available surface observation, and in this sense, the guidance forecasts for the 12-, 18-, and 24-h projections are actually 9-, 15-, and 21-h forecasts.

Tables 5.2 and 5.4 show the scores for the ceiling forecasts from 0000 and 1200 GMT, respectively. In terms of log score, skill score, and percent correct, the 0000 GMT cycle local forecasts were as good as or better than persistence for all four projections, and as good as or better than the guidance for the 12- and 18-h projections (guidance forecasts are not

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[4]This score is proportional to the absolute value of $\log_{10} f_i - \log_{10} O_i$ where f_i is the forecast category for each case and O_i is the observed category for each case. The result is averaged over all cases and scaled by multiplying by 50.

available for the 15-h projection). The guidance was better than the locals at 24 hours. Also, the guidance was better than persistence for the 18- and 24-h projections. The 1200 GMT cycle comparisons among the three forecast systems were similar to those for the 0000 GMT cycle, except the log and skill scores for local forecasts were also better than the guidance for the 24-h projection, and persistence was better than the locals at 12 hours. In terms of bias by category, the guidance had the best overall scores for both cycles.

Tables 5.3 and 5.5 show the scores for the visibility forecasts for the 0000 and 1200 GMT cycles, respectively. In terms of log score and percent correct, the 0000 GMT cycle local forecasts of visibility were better than the guidance for all projections; the local forecasts also were better than persistence for the 15-, 18-, and 24-h projections but not for the 12-h projection. The guidance was better than persistence for the 18- and 24-h projections. In terms of skill score, the guidance was as good as or better than the local forecasts for the 18- and 24-h projections. The 1200 GMT cycle persistence forecasts of visibility were better than the locals for all four projections in terms of log score and percent correct except for the log score at 24 hours. The locals were better than the guidance for all three projections except for percent correct at 18 hours. In terms of skill score, the locals were better than persistence for the 18- and 24-h projections, and they were better than the guidance for all three projections. Overall, the guidance had slightly better biases by category than the locals for both the 0000 and 1200 GMT cycles.

6. MAXIMUM/MINIMUM TEMPERATURE

The max/min temperature guidance for the 1984 warm season was generated by the LFM-based regression equations described in Technical Procedures Bulletin No. 344 (National Weather Service, 1984). The guidance was based on equations developed by stratifying archived LFM model forecasts, station observations, and the first two harmonics of the day of the year into seasons of 3-mo duration (Dallavalle et al., 1980). We defined spring as March-May, summer as June-August, and fall as September-November. Since the MOS max/min guidance is valid for the local calendar day, the first period (approximately 24-h) objective forecast of the max based on 0000 GMT model data is for the calendar day starting at the subsequent midnight. The max/min guidance for the other periods (projections of approximately 36, 48, and 60 hours) also correspond to specific calendar days. In contrast, the subjective local forecasts are for daytime max and nighttime min. Thus, the first period subjective max forecast from 0000 GMT data is for today's high. The second period forecast is for tonight's low and so forth. A similar procedure is followed for the 1200 GMT cycle, except the first period is tonight's min. For the local forecast, daytime is defined to be approximately from 1200 to 0000 GMT. Nighttime then extends approximately from 0000 to 1200 GMT except in the western parts of the Central and Southern Regions and throughout the entire Western Region where nighttime may go to nearly 1800 GMT.

In this report, we present results for both objective guidance and subjective local forecasts which were verified by using a 12-h synoptic observation obtained from the AFOS-era verification system. In particular, the 0000 GMT synoptic report of the max is valid for the 1200 to 0000 GMT period, while the 1200 GMT observation for the preceding 0000 to 1200 GMT period is used for the min. Note that the 0000 GMT max temperature observation represents the daytime high most of the time during the warm season, particularly in the eastern half of the United States. However, in the western part of the country, the daytime max occasionally occurs after 0000 GMT (1600 LST). Obviously, for these cases the 0000 GMT observation is inadequate. In an analogous manner, the 1200 GMT min temperature observation occasionally underestimates the actual nighttime low. In the western United States, where 1200 GMT corresponds to 0400 LST, the nighttime low often occurs after 1200 GMT. Thus, we suspect that the errors for both the max and min forecasts are overestimates. Unfortunately, no existing synoptic report accurately represents the daytime max or nighttime min in all circumstances. However, the local forecasters have the option of replacing the observed max or min from the synoptic report with a more representative observation. This problem with the verifying observations will be corrected for the 1984-85 cool season when new local software is implemented to derive an appropriate daytime high and nighttime low from a combination of synoptic and hourly reports.

We verified the local and MOS max/min temperature forecasts for both the 0000 and 1200 GMT cycles. The mean algebraic error (forecast minus observed temperature), mean absolute error, the number of absolute errors >10°F, the probability of detection[5] of min temperatures ≤32°F, and the false alarm ratio[6] for min temperatures ≤32°F were computed for 93 stations in the conterminous United States (Table 2.1). At 0000 (1200) GMT, the local max temperature forecasts are valid for daytime periods ending approximately 24 (36) and 48 (60) hours after 0000 (1200) GMT. Similarly, at 0000 (1200) GMT, the local min temperature forecasts are valid for nighttime periods ending approximately 36 (24) and 60 (48) hours after 0000 (1200) GMT.

For all stations combined, the results for 0000 and 1200 GMT are shown in Tables 6.1 and 6.6, respectively. A matched sample of approximately 14,500 cases per forecast projection was available. Similarly, Tables 6.2-6.5 give the 0000 GMT verification scores for the Eastern, Southern, Central, and Western Regions, respectively. Tables 6.7-6.10 show analogous scores by NWS region for the 1200 GMT cycle.

For all regions, both forecast cycles, and all projections, the local and the MOS max temperature forecasts exhibited a warm bias (positive algebraic error). Tables 6.1 and 6.6 show for all stations combined that the bias in the MOS max forecasts ranged from 0.7°F for tomorrow's max (0000 GMT) to 1.2°F for the day after tomorrow's max (1200 GMT). For the local forecasts, the biases for the same projections were 0.6°F and 1.0°F, respectively. These warm biases in the max forecasts were persistent from region to region. However, the bias in the MOS guidance was always larger than that of the local forecasts except for two projections in the Southern Region. As discussed earlier, at least a portion of the forecast bias (both local and MOS) may be related to the time of observation and not to a specific meteorological factor. In terms of mean absolute

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[5]Here, the probability of detection is defined to be the fraction of time the min temperature was correctly forecast to be ≤32°F when the previous day's min was ≥40°F.

[6]Here, the false alarm ratio is defined to be the fraction of forecasts of ≤32°F that failed to verify when the previous day's min was ≥40°F.

error, the local max forecasts averaged 0.2°F more accurate than the MOS guidance for the four projections and all stations combined. This superiority was evident in the local forecasts for each of the four regions although the greatest difference in accuracy between the MOS and the subjective forecasts occurred in the Western Region. Note that for all stations combined, the percentage of absolute errors greater than 10°F exceeded 5% only for the forecast of the day after tomorrow's max from 1200 GMT data (Table 6.6).

Analogous trends are evident in the verification statistics for the min forecasts. For all stations combined, both the MOS and local forecasts showed a cold bias (negative algebraic error) in each of the four projections. With the exception of the forecast for tonight's min (0000 GMT) in the Southern Region, the regional results had the same cold tendency. The largest bias occurred in the Western Region, but this feature may be due to the observation time and not to any meteorological cause. In nearly all regions and all projections, the bias in the local forecasts was less than that for the MOS guidance. In terms of mean absolute error, the local min temperature forecasts for all regions and all projections averaged 0.2°F more accurate than the guidance. In fact, this improvement of the local forecasts remained relatively constant from region to region. Generally, MOS predicted more "critical events" than did the locals, so the probability of detection of temperatures ≤32°F was greater for the guidance, but the local forecasts had a smaller false alarm ratio. However, the small number of cases during the warm season make these values rather unstable.

The verifications in Tables 6.1 and 6.6 indicate that for approximately similar projections, the max temperature was slightly more difficult to predict than the min. As an example, the mean absolute error for the 36-h projection of the max (tomorrow's max) from 1200 GMT was 3.4 and 3.7°F for the local forecasts and the guidance, respectively. For the 36-h projection of the min (tonight's min) from 0000 GMT, the corresponding errors were 3.1 and 3.3°F for the local forecasts and the guidance, respectively. For all four projections combined, the absolute error for both the local and MOS max forecasts averaged 0.2°F more than for the min forecasts. This trend in the relative difficulty of forecasting the max or min was generally evident in the scores for all regions and all projections, but it was most pronounced in the Eastern Region. Usually, the max is more difficult to forecast than the min during the warm season because of the greater variability of the max temperature. The difference in predictability is likely due to the effects of localized convective activity on daytime heating (e.g., Schwartz, 1984). Clearly, both the guidance and the local forecasters often have difficulties in recognizing and predicting the impact of mesoscale convective outbreaks.

7. SUMMARY

Highlights of the 1984 warm season verification results, summarized by general type of weather element, are:

- Probability of Precipitation - The PoP verification involved 93 stations and forecast projections of 12-24, 24-36, and 36-48 hours from 0000 and 1200 GMT. The NWS Brier scores for all stations combined indicate the local forecasts were better than the guidance for the first period (on the order of 3.0%), but there was little difference in accuracy for the two sets of forecasts for the second and third periods. Depending on the projection and cycle, the local forecasters deviated from the guidance about 55% of the time, and these changes were in the correct direction from 48% to 55% of the time.

- Surface Wind - The AFOS-era wind verification involved the comparison of surface wind speed and direction forecasts for 93 (94) stations for projections of 12 and 18 hours from 0000 (1200) GMT. In this system, the local forecasts were obtained from NWS official terminal forecasts. Several fundamental differences exist between the MOS wind forecasts and those in the FT's. For example, the FT's are not as precise in regard to valid time as are the objective forecasts. Due to these differences, only conclusions of a general nature can be drawn from the results. The statistics for all stations combined for wind direction indicate the locals were able to improve upon MOS for the 12-h forecast projection from both 0000 and 1200 GMT. The guidance for the 18-h projection for both cycles, on the other hand, was superior to the locals and by a wider margin. The overall results for the speed forecasts indicate that the locals were generally better than the guidance in terms of the mean absolute and mean algebraic errors. Also, the locals were marginally better than the guidance for percent correct for all but the 18-h projection after 1200 GMT. In terms of skill score, MOS was superior for all but the 12-h projection after 0000 GMT.

- Cloud Amount - The verification for cloud amount involved 92 stations and forecasts for projections of 12, 18, and 24 hours from 0000 and 1200 GMT. The skill scores and percents correct for all stations combined indicate the 0000 GMT cycle local forecasts were better than the guidance for the 12-h projection; there was little difference at 18 hours, and MOS was better at 24 hours. For the 1200 GMT cycle, the local forecasts were better at the 12-h projection and guidance was better at the 18- and 24-h projections. In terms of bias by category (clear, scattered, broken, and overcast) for both cycles and all projections, the results varied by category and forecast projection, but overall, the guidance was slightly better.

- Ceiling and Visibility - The verification involved the comparison of local forecasts, MOS guidance, and persistence for 93 (94) stations for projections of 12, 15, 18, and 24 hours from 0000 (1200) GMT. Direct comparison of local, MOS, and persistence forecasts was possible for the 12-, 18-, and 24-h projections. These are actually 3-, 9-, and 15-h forecasts from the latest available surface observations for the locals and persistence, and in this sense, they are 9-, 15-, and 21-h forecasts for the guidance. For both forecast cycles, the log score, percent correct, and skill score indicate that the locals were better than the guidance at the 12-h projection, but not as good as persistence. For the 15-h projection, the locals were better than (about the same as) persistence for ceiling (visibility). For the 18-h projection, most scores indicate that the local forecasts of ceiling and visibility were better than the guidance and persistence forecasts for both cycles; the guidance forecasts also were better than persistence, except for the 1200 GMT cycle visibility forecasts. For the 24-h projection, indications of accuracy and skill varied considerably by cycle, element, and score.

- Maximum/Minimum Temperature - Objective and local forecasts were verified for 93 stations for both the 0000 and 1200 GMT cycles. At 0000 (1200) GMT, the local maximum temperature forecasts were valid for daytime periods approximately 24 (36) and 48 (60) hours in advance, while the minimum temperature forecasts were valid for nighttime periods ending approximately 36 (24) and 60 (48) hours after initial model time. In contrast, the MOS guidance was valid for calendar day periods. The verifying observations were usually max or min temperatures for 12-h periods ending at 0000 and 1200 GMT, respectively. For all stations and projections combined, we found that the mean absolute errors of the local max and min temperature forecasts averaged 0.2°F less than that for the MOS guidance. Clearly, the local forecasters are improving over the guidance, although some of this improvement probably is associated with the differences between the valid periods of the two types of forecasts and the verifying observations. As is usual during the warm season, the minimum temperature forecasts verified better for the same projection than did the maximum temperature forecasts.

8. ACKNOWLEDGMENTS

We are grateful to Fred Marshall and Eston Pennington for assistance in archiving the data, and also to Belinda Howard and Gladys Hodge for typing the text and the many tables shown in this report.

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Table 2.1. Ninety-four stations used for comparative verification of MOS guidance and local probability of precipitation, surface wind, cloud amount, ceiling height, visibility, and max/min temperature forecasts. Please note that LAX was not included in the PoP and max/min temperature verifications. LAX and SAN were not included in the cloud amount verifications. TCC was not available during the 0000 GMT cycle for surface wind, ceiling height, and visibility.

DCA	Washington, D.C.	ORF	Norfolk, Virginia
PWM	Portland, Maine	CON	Concord, New Hampshire
BOS	Boston, Massachusetts	PVD	Providence, Rhode Island
ALB	Albany, New York	BTV	Burlington, Vermont
BUF	Buffalo, New York	SYR	Syracuse, New York
LGA	New York (LaGuardia), New York	EWR	Newark, New Jersey
RDU	Raleigh-Durham, North Carolina	CLT	Charlotte, North Carolina
CLE	Cleveland, Ohio	CMH	Columbus, Ohio
PHL	Philadelphia, Pennsylvania	ACY	Atlantic City, New Jersey
PIT	Pittsburgh, Pennsylvania	ERI	Erie, Pennsylvania
CAE	Columbia, South Carolina	CHS	Charleston, South Carolina
CRW	Charleston, West Virginia	BKW	Beckley, West Virginia
BHM	Birmingham, Alabama	MOB	Mobile, Alabama
LIT	Little Rock, Arkansas	FSM	Fort Smith, Arkansas
MIA	Miami, Florida	TPA	Tampa, Florida
ATL	Atlanta, Georgia	SAV	Savannah, Georgia
MSY	New Orleans, Louisiana	SHV	Shreveport, Louisiana
JAN	Jackson, Mississippi	MEI	Meridian, Mississippi
ABQ	Albuquerque, New Mexico	TCC	Tucumcari, New Mexico
OKC	Oklahoma City, Oklahoma	TUL	Tulsa, Oklahoma
MEM	Memphis, Tennessee	BNA	Nashville, Tennessee
DFW	Dallas-Ft. Worth, Texas	ABI	Abilene, Texas
LBB	Lubbock, Texas	ELP	El Paso, Texas
SAT	San Antonio, Texas	IAH	Houston, Texas
DEN	Denver, Colorado	GJT	Grand Junction, Colorado
ORD	Chicago (O'Hare), Illinois	SPI	Springfield, Illinois
IND	Indianapolis, Indiana	SBN	South Bend, Indiana
DSM	Des Moines, Iowa	ALO	Waterloo, Iowa
TOP	Topeka, Kansas	ICT	Wichita, Kansas
SDF	Louisville, Kentucky	LEX	Lexington, Kentucky
DTW	Detroit, Michigan	GRR	Grand Rapids, Michigan
MSP	Minneapolis, Minnesota	DLH	Duluth, Minnesota
STL	St. Louis, Missouri	MCI	Kansas City, Missouri
OMA	Omaha, Nebraska	LBF	North Platte, Nebraska
BIS	Bismarck, North Dakota	FAR	Fargo, North Dakota
FSD	Sioux Falls, South Dakota	RAP	Rapid City, South Dakota
MKE	Milwaukee, Wisconsin	MSN	Madison, Wisconsin
CYS	Cheyenne, Wyoming	CPR	Casper, Wyoming
PHX	Phoenix, Arizona	TUS	Tucson, Arizona
LAX	Los Angeles, California	SAN	San Diego, California
SFO	San Francisco, California	FAT	Fresno, California
BOI	Boise, Idaho	PIH	Pocatello, Idaho
GTF	Great Falls, Montana	HLN	Helena, Montana
RNO	Reno, Nevada	LAS	Las Vegas, Nevada
PDX	Portland, Oregon	MFR	Medford, Oregon
SLC	Salt Lake City, Utah	CDC	Cedar City, Utah
SEA	Seattle-Tacoma, Washington	GEG	Spokane, Washington

Table 2.2. Comparative verification of MOS guidance and local PoP forecasts for 93 stations, 0000 GMT cycle.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.1048		29.0			
(1st period)	Local	.1013	3.4	31.4	14412	8325	54.2
24-36	MOS	.1101		23.9			
(2nd period)	Local	.1095	0.6	24.3	14355	7956	52.3
36-48	MOS	.1213		19.0			
(3rd period)	Local	.1222	-0.8	18.3	14378	7938	48.6

Table 2.3. Same as Table 2.2 except for 24 stations in the Eastern Region.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.1177		35.5			
(1st period)	Local	.1177	0.0	35.5	3252	2039	52.9
24-36	MOS	.1250		29.5			
(2nd period)	Local	.1250	0.0	29.6	3236	1903	57.0
36-48	MOS	.1388		25.3			
(3rd period)	Local	.1403	-1.1	24.5	3235	1915	53.1

Table 2.4. Same as Table 2.2 except for 24 stations in the Southern Region.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.1097		21.7			
(1st period)	Local	.1054	3.9	24.8	3891	2340	53.1
24-36	MOS	.0969		18.0			
(2nd period)	Local	.0985	-1.6	16.7	3822	2196	48.3
36-48	MOS	.1220		14.5			
(3rd period)	Local	.1226	-0.5	14.1	3890	2281	49.4

Table 2.5. Same as Table 2.2 except for 28 stations in the Central Region.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.1085		31.3			
(1st period)	Local	.1040	4.1	34.1	4554	2498	57.8
24-36	MOS	.1220		26.2			
(2nd period)	Local	.1205	1.2	27.1	4565	2394	57.6
36-48	MOS	.1284		19.0			
(3rd period)	Local	.1297	-1.1	18.2	4551	2326	46.9

Table 2.6. Same as Table 2.2 except for 17 stations in the Western Region.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.0763		23.4			
(1st period)	Local	.0713	6.6	28.5	2715	1448	51.5
24-36	MOS	.0909		15.9			
(2nd period)	Local	.0881	3.1	18.5	2732	1463	43.3
36-48	MOS	.0872		13.7			
(3rd period)	Local	.0872	0.0	13.7	2702	1416	44.1

Table 2.7. Comparative verification of MOS guidance and local PoP forecasts for 93 stations, 1200 GMT cycle.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.1039		28.1			
(1st period)	Local	.1010	2.8	30.1	14312	8264	54.5
24-36	MOS	.1155		22.5			
(2nd period)	Local	.1156	-0.1	22.5	14346	7964	47.5
36-48	MOS	.1199		17.3			
(3rd period)	Local	.1198	0.1	17.3	14273	7753	54.3

Table 2.8. Same as Table 2.7 except for 24 stations in the Eastern Region.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.1180		32.8			
(1st period)	Local	.1154	2.1	34.2	3197	1983	55.9
24-36	MOS	.1324		28.1			
(2nd period)	Local	.1339	-1.2	27.2	3206	1894	51.3
36-48	MOS	.1392		22.3			
(3rd period)	Local	.1385	0.5	22.7	3179	1860	56.7

Table 2.9. Same as Table 2.7 except for 24 stations in the Southern Region.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.0947		19.6			
(1st period)	Local	.0928	2.0	21.3	3794	2256	51.4
24-36	MOS	.1145		18.1			
(2nd period)	Local	.1147	-0.2	17.9	3854	2296	48.0
36-48	MOS	.1033		12.0			
(3rd period)	Local	.1048	-1.5	10.7	3781	2263	52.3

Table 2.10. Same as Table 2.7 except for 28 stations in the Central Region.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.1153		30.9			
(1st period)	Local	.1120	2.9	32.9	4593	2637	57.1
24-36	MOS	.1235		22.8			
(2nd period)	Local	.1234	0.1	22.9	4580	2409	45.1
36-48	MOS	.1342		18.8			
(3rd period)	Local	.1341	0.1	18.8	4592	2315	58.2

Table 2.11. Same as Table 2.7 except for 17 stations in the Western Region.

Projection (h)	Type of Forecast	Brier Score	% Imp. Over Guid.	% Imp. Over Clim.	No. of Cases	No. of Changes to Guid.	% Changes Correct Direction
12-24	MOS	.0810		24.6			
(1st period)	Local	.0770	4.9	28.3	2728	1388	52.6
24-36	MOS	.0834		18.3			
(2nd period)	Local	.0819	1.8	19.7	2706	1365	45.6
36-48	MOS	.0963		11.7			
(3rd period)	Local	.0947	1.7	13.2	2721	1315	47.5

Table 3.1. Definition of the categories used for MOS guidance, local forecasts, and surface observations of wind direction and speed.

Category	Direction (degrees)	Speed (kt)
1	340-20	$\leq$ 12
2	30-60	13-17
3	70-110	18-22
4	120-150	23-27
5	160-200	28-32
6	210-240	$\geq$ 33
7	250-290	---
8	300-330	---

Table 3.2. Comparative verification of MOS guidance and local surface wind forecasts for 93 stations, 0000 GMT cycle.

Fcst. Proj. (h)	Type of Fcst.	Direction: Mean Abs. Error (Deg)	Direction: Skill Score	Direction: No. of Cases	Speed: Mean Abs. Error (Kts)	Speed: Mean Alg. Error (Kts)	Speed: No. of Cases	Contingency Table: Skill Score	Contingency Table: Percent Fcst. Correct	Contingency Table: Threat Score (>27 Kts)	Bias by Category: 1 (No. Obs)	Bias by Category: 2 (No. Obs)	Bias by Category: 3 (No. Obs)	Bias by Category: 4 (No. Obs)	Bias by Category: 5 (No. Obs)	Bias by Category: 6 (No. Obs)	No. of Cases
12	MOS	21	.544	2236	3.5	2.1	2248	.345	90.9	.18	0.99	1.15	1.46	1.43	0.60	1.00	14570
	Local	20	.577		3.0	1.7		.398	91.9	.20	0.99 (13586)	1.16 (820)	0.96 (129)	0.78 (23)	0.50 (10)	0.50 (2)	
18	MOS	26	.450	5443	3.4	1.6	5464	.388	77.5	.13	0.98	1.00	1.28	1.45	1.28	0.56	14597
	Local	29	.409		3.2	0.9		.356	77.8	.16	1.02 (11445)	1.02 (2440)	0.71 (574)	0.51 (104)	0.32 (25)	0.22 (9)	

Table 3.3. Contingency tables for MOS guidance and local surface wind direction forecasts for 93 stations, 0000 GMT cycle.

12-h Forecasts

MOS

		1	2	3	4	5	6	7	8	T
	1	168	34	6	2	7	2	9	49	277
	2	29	67	33	4	3	1	2	5	144
	3	1	27	111	31	7	3	1	1	182
OBS	4	1	1	24	113	102	4	1	1	247
	5	2	2	6	49	364	67	8	2	500
	6	1	0	1	2	70	178	38	4	294
	7	5	2	2	0	12	32	202	54	309
	8	43	2	3	0	5	8	62	160	283
	T	250	135	186	201	570	295	323	276	2236

Local

		1	2	3	4	5	6	7	8	T
	1	179	36	6	1	4	5	6	40	277
	2	33	64	38	3	2	0	1	3	144
	3	2	15	119	36	8	2	0	0	182
OBS	4	1	2	14	144	80	2	3	1	247
	5	3	1	5	44	392	44	7	4	500
	6	3	0	1	1	69	176	40	4	294
	7	8	0	0	4	10	39	177	71	309
	8	49	2	3	0	4	6	44	175	283
	T	278	120	186	233	569	274	278	298	2236

18-h Forecasts

MOS

		1	2	3	4	5	6	7	8	T
	1	309	67	14	6	14	13	36	124	583
	2	76	94	56	10	9	11	4	18	278
	3	19	37	180	75	31	13	10	12	377
OBS	4	3	4	61	156	221	26	12	3	486
	5	8	2	11	83	833	255	30	11	1233
	6	4	0	0	6	218	483	170	10	891
	7	19	0	1	4	32	187	486	121	850
	8	117	6	5	3	13	35	195	371	745
	T	555	210	328	343	1371	1023	943	670	5443

Local

		1	2	3	4	5	6	7	8	T
	1	279	75	7	10	22	11	25	154	583
	2	61	108	53	11	12	10	3	20	278
	3	22	37	163	85	34	16	8	12	377
OBS	4	4	6	52	200	189	20	9	6	486
	5	11	1	16	158	824	184	26	13	1233
	6	7	0	4	19	340	397	103	21	891
	7	18	5	0	7	65	215	375	165	850
	8	130	7	6	5	16	34	172	375	745
	T	532	239	301	495	1502	887	721	766	5443

Table 3.4. Contingency tables for MOS guidance and local surface wind speed forecasts for 93 stations, 0000 GMT cycle.

12-h Forecasts

MOS

		1	2	3	4	5	6	T
	1	12922	586	74	4	0	0	13586
	2	447	288	73	11	0	1	820
	3	26	58	31	12	2	0	129
OBS	4	4	6	7	4	2	0	23
	5	2	1	3	1	2	1	10
	6	1	0	0	1	0	0	2
	T	13402	939	188	33	6	2	14570

Local

		1	2	3	4	5	6	T
	1	13010	547	27	2	0	0	13586
	2	434	338	46	2	0	0	820
	3	22	60	39	7	1	0	129
OBS	4	3	5	8	5	2	0	23
	5	0	2	4	2	1	1	10
	6	1	0	0	0	1	0	2
	T	13470	952	124	18	5	1	14570

18-h Forecasts

MOS

		1	2	3	4	5	6	T
	1	10100	1186	148	9	2	0	11445
	2	1041	1003	345	47	4	0	2440
	3	82	228	191	62	11	0	574
OBS	4	3	23	45	21	10	2	104
	5	1	4	7	10	2	1	25
	6	1	0	1	2	3	2	9
	T	11228	2444	737	151	32	5	14597

Local

		1	2	3	4	5	6	T
	1	10208	1163	73	1	0	0	11445
	2	1284	995	145	16	0	0	2440
	3	139	282	136	16	1	0	574
OBS	4	6	39	44	12	3	0	104
	5	2	8	6	6	2	1	25
	6	1	0	3	2	2	1	9
	T	11640	2487	407	53	8	2	14597

Table 3.5. Same as Table 3.2 except for 24 stations in the Eastern Region.

Fcst. Proj. (h)	Type of Fcst.	Direction: Mean Abs. Error (Deg)	Direction: Skill Score	Direction: No. of Cases	Speed: Mean Abs. Error (Kts)	Speed: Mean Alg. Error (Kts)	Speed: No. of Cases	Contingency Table: Skill Score	Contingency Table: Percent Fcst. Correct	Contingency Table: Threat Score (>27 Kts)	Bias by Category: 1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	21	.525	573	3.0	1.7	577	.329	91.1	.00	1.00	0.95	2.85	0.57	*	*	3408
	Local	19	.560		2.6	1.3		.375	92.1	.00	1.00 (3172)	0.96 (216)	1.15 (13)	0.43 (7)	* (0)	* (0)	
18	MOS	28	.421	1440	3.0	1.3	1446	.377	77.4	.13	1.00	0.96	1.32	1.08	1.25	*	3428
	Local	32	.362		2.9	0.8		.313	76.9	.20	1.05 (2659)	0.89 (661)	0.45 (91)	0.54 (13)	0.25 (4)	** (0)	

* This category was neither forecast nor observed.
** This category was forecast once but was not observed.

Table 3.6. Same as Table 3.2 except for 23 stations in the Southern Region.

Fcst. Proj. (h)	Type of Fcst.	Direction			Speed												
								Contingency Table									
											Bias by Category						
		Mean Abs. Error (Deg)	Skill Score	No. of Cases	Mean Abs. Error (Kts)	Mean Alg. Error (Kts)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 Kts)	1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	22	.542	466	3.7	2.4	470	.355	94.0	.00	0.99	1.23	1.81	1.00	0.00	0.00	3819
	Local	20	.570		3.3	2.3		.423	93.5	.00	0.98 (3343)	1.41 (150)	1.33 (21)	1.00 (3)	0.00 (1)	0.00 (1)	
18	MOS	24	.442	1283	3.3	1.8	1288	.404	81.3	.00	0.96	1.13	1.53	1.75	0.57	0.00	3796
	Local	26	.421		3.2	1.1		.380	82.0	.13	0.99 (3161)	1.17 (510)	0.48 (105)	1.00 (12)	0.14 (7)	0.00 (1)	

Table 3.7. Same as Table 3.2 except for 28 stations in the Central Region.

		Direction			Speed												
								Contingency Table									
											Bias by Category						
Fcst. Proj. (h)	Type of Fcst.	Mean Abs. Error (Deg)	Skill Score	No. of Cases	Mean Abs. Error (Kts)	Mean Alg. Error (Kts)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 Kts)	1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	19	.578	839	3.5	2.1	839	.370	88.5	.17	0.98	1.09	1.40	2.67	0.83	2.00	4448
	Local	19	.608		2.9	1.6		.409	89.3	.20	0.98 (4042)	1.24 (328)	0.89 (62)	0.89 (9)	0.67 (6)	1.00 (1)	
18	MOS	23	.496	2077	3.4	1.4	2080	.380	71.8	.21	1.00	0.90	1.21	1.56	1.64	0.83	4482
	Local	26	.441		3.2	0.6		.355	71.5	.20	1.01 (3170)	1.06 (958)	0.82 (274)	0.41 (63)	0.55 (11)	0.17 (6)	

Table 3.8. Same as Table 3.2 except for 18 stations in the Western Region.

		Direction			Speed												
								Contingency Table									
											Bias by Category						
Fcst. Proj. (h)	Type of Fcst.	Mean Abs. Error (Deg)	Skill Score	No. of Cases	Mean Abs. Error (Kts)	Mean Alg. Error (Kts)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 Kts)	1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	27	.437	360	3.8	2.1	362	.282	91.0	.33	0.98	1.52	0.79	0.50	0.33	*	2895
	Local	24	.491		3.4	1.7		.352	93.1	.33	1.00 (2729)	1.02 (126)	0.79 (33)	1.00 (4)	0.33 (3)	* (0)	
18	MOS	38	.312	643	4.4	2.5	650	.358	81.6	.00	0.97	1.19	1.19	1.13	1.67	0.00	2891
	Local	39	.319		4.1	1.7		.328	83.1	.00	1.02 (2455)	0.92 (311)	0.88 (104)	0.50 (16)	0.60 (3)	0.00 (2)	

* This category was neither forecast nor observed.

Table 3.9. Comparative verification of MOS guidance and local surface wind forecasts for 94 stations, 1200 GMT cycle.

Fcst. Proj. (h)	Type of Fcst.	Direction			Speed											
								Contingency Table								
											Bias by Category					
		Mean Abs. Error (Deg)	Skill Score	No. of Cases	Mean Abs. Error (Kts)	Mean Alg. Error (Kts)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 Kts)	1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	26	.474	4628	3.4	1.7	4641	.380	79.9	.15	0.98	1.04	1.14	1.45	1.14	1.17	14668
	Local	25	.484		3.1	1.2		.378	80.2	.19	0.99 (11963)	1.09 (2050)	0.94 (518)	0.59 (109)	0.55 (22)	0.50 (6)	
18	MOS	27	.475	2364	3.9	2.5	2383	.321	89.0	.06	0.99	1.13	1.22	0.91	1.25	0.60	14494
	Local	31	.425		3.9	2.3		.276	88.2	.00	0.99 (13305)	1.24 (953)	0.96 (180)	0.32 (47)	0.75 (4)	0.00 (5)	

Table 3.10. Contingency tables for MOS guidance and local surface wind direction forecasts for 94 stations, 1200 GMT cycle.

12-h Forecasts

MOS

		1	2	3	4	5	6	7	8	T
	1	232	56	14	9	15	12	47	111	496
	2	44	69	68	11	10	10	11	13	236
	3	9	33	157	72	31	7	12	4	325
OBS	4	4	0	39	231	159	15	11	6	465
	5	4	3	8	108	711	171	38	8	1051
	6	2	1	2	11	102	266	156	6	546
	7	9	1	1	6	20	121	578	117	853
	8	71	3	1	2	11	30	215	323	656
	T	375	166	290	450	1059	632	1068	588	4628

Local

		1	2	3	4	5	6	7	8	T
	1	252	49	9	9	10	21	12	134	496
	2	47	96	56	11	8	5	5	8	236
	3	3	37	151	85	29	9	2	9	325
OBS	4	2	2	23	222	187	18	8	3	465
	5	3	3	8	78	741	172	33	13	1051
	6	4	0	2	7	129	260	125	19	546
	7	21	1	2	4	24	151	505	145	853
	8	72	2	1	5	14	29	157	376	656
	T	404	190	252	421	1142	665	847	707	4628

18-h Forecasts

MOS

		1	2	3	4	5	6	7	8	T
	1	97	23	7	11	17	7	13	52	227
	2	25	35	37	7	6	2	3	3	118
	3	6	22	125	52	16	1	2	1	225
OBS	4	1	3	39	159	111	5	2	2	322
	5	3	2	9	64	462	63	16	2	621
	6	1	0	0	5	61	155	52	7	281
	7	4	1	3	3	15	54	172	43	295
	8	43	4	3	9	6	13	83	114	275
	T	180	90	223	310	694	300	343	224	2364

Local

		1	2	3	4	5	6	7	8	T
	1	109	23	9	8	15	8	13	42	227
	2	24	34	37	11	5	1	2	4	118
	3	8	19	108	63	18	3	3	3	225
OBS	4	4	3	29	152	117	8	4	5	322
	5	2	3	10	60	432	89	16	9	621
	6	5	2	1	7	60	118	75	13	281
	7	8	2	2	8	21	42	133	79	295
	8	50	6	5	9	9	15	49	132	275
	T	210	92	201	318	677	284	295	287	2364

Table 3.11. Contingency tables for MOS guidance and local surface wind speed forecasts for 94 stations, 1200 GMT cycle.

12-h Forecasts — MOS

		1	2	3	4	5	6	T
	1	10706	1107	127	22	1	0	11963
	2	951	807	240	46	4	2	2050
	3	91	187	175	55	10	0	518
OBS	4	15	22	36	29	6	1	109
	5	1	2	9	6	3	1	22
	6	1	0	1	0	1	3	6
	T	11765	2125	588	158	25	7	14668

12-h Forecasts — Local

		1	2	3	4	5	6	T
	1	10737	1156	68	2	0	0	11963
	2	1024	831	180	13	2	0	2050
	3	87	227	178	25	1	0	518
OBS	4	15	20	52	17	4	1	109
	5	1	3	8	7	3	0	22
	6	1	0	1	0	2	2	6
	T	11865	2237	487	64	12	3	14668

18-h Forecasts — MOS

		1	2	3	4	5	6	T
	1	12533	681	81	9	1	0	13305
	2	545	315	76	16	1	0	953
	3	61	69	41	6	2	1	180
OBS	4	8	8	20	9	1	1	47
	5	0	1	0	3	0	0	4
	6	2	1	1	0	0	1	5
	T	13149	1075	219	43	5	3	14494

18-h Forecasts — Local

		1	2	3	4	5	6	T
	1	12448	783	68	5	1	0	13305
	2	587	304	60	2	0	0	953
	3	73	77	25	5	0	0	180
OBS	4	12	14	16	3	2	0	47
	5	0	2	2	0	0	0	4
	6	2	2	1	0	0	0	5
	T	13122	1182	172	15	3	0	14494

Table 3.12. Same as Table 3.9 except for 24 stations in the Eastern Region.

		Direction			Speed												
								Contingency Table									
											Bias by Category						
Fcst. Proj. (h)	Type of Fcst.	Mean Abs. Error (Deg)	Skill Score	No. of Cases	Mean Abs. Error (Kts)	Mean Alg. Error (Kts)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 Kts)	1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	27	.419	723	3.1	1.9	726	.348	88.5	1.00	0.99	1.03	1.12	6.00	**	0.00	3411
	Local	25	.477		3.4	2.1		.256	85.2	1.00	0.96 (3089)	1.32 (295)	1.60 (25)	2.00 (1)	** (0)	0.00 (1)	
18	MOS	27	.458	461	3.6	2.3	466	.298	92.4	.00	1.00	1.03	0.86	4.00	*	0.00	3386
	Local	32	.383		3.9	2.7		.271	90.9	.00	0.98 (3196)	1.42 (166)	0.86 (22)	4.00 (1)	* (0)	0.00 (1)	

* This category was neither forecast nor observed.
** This category was forecast once but was not observed.

Table 3.13. Same as Table 3.9 except for 24 stations in the Southern Region.

		Direction			Speed												
								Contingency Table									
											Bias by Category						
Fcst. Proj. (h)	Type of Fcst.	Mean Abs. Error (Deg)	Skill Score	No. of Cases	Mean Abs. Error (Kts)	Mean Alg. Error (Kts)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 Kts)	1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	24	.491	1099	3.3	1.8	1102	.382	82.1	.18	0.97	1.14	1.15	1.60	0.67	0.50	3858
	Local	24	.478		2.9	1.1		.392	83.5	.25	1.00 (3257)	1.10 (464)	0.67 (109)	0.90 (20)	0.33 (6)	0.00 (2)	
18	MOS	26	.492	591	4.1	2.6	592	.310	89.5	.00	0.98	1.35	1.14	0.83	0.00	*	3737
	Local	30	.429		3.7	1.7		.303	90.3	.00	0.99 (3469)	1.30 (204)	0.40 (50)	0.17 (12)	0.00 (2)	* (0)	

* This category was neither forecast nor observed.

Table 3.14. Same as Table 3.9 except for 28 stations in the Central Region.

Fcst. Proj. (h)	Type of Fcst.	Direction			Speed												
								Contingency Table									
											Bias by Category						
		Mean Abs. Error (Deg)	Skill Score	No. of Cases	Mean Abs. Error (Kts)	Mean Alg. Error (Kts)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 Kts)	1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	26	.492	1757	3.4	1.7	1761	.371	76.8	.15	0.98	0.99	1.27	1.63	2.00	1.67	4546
	Local	25	.494		3.2	1.6		.396	76.8	.25	0.95 (3562)	1.23 (750)	1.17 (191)	0.71 (35)	0.80 (5)	1.00 (3)	
18	MOS	26	.472	937	4.0	2.5	945	.336	86.3	.08	0.99	1.05	1.48	1.05	2.50	0.75	4525
	Local	29	.456		3.9	2.3		.298	84.7	.00	0.97 (4042)	1.34 (382)	1.26 (73)	0.32 (22)	1.00 (2)	0.00 (4)	

Table 3.15. Same as Table 3.9 except for 18 stations in the Western Region.

		Direction			Speed												
								Contingency Table									
											Bias by Category						
Fcst. Proj. (h)	Type of Fcst.	Mean Abs. Error (Deg)	Skill Score	No. of Cases	Mean Abs. Error (Kts)	Mean Alg. Error (Kts)	No. of Cases	Skill Score	Percent Fcst. Correct	Threat Score (>27 Kts)	1 (No. Obs)	2 (No. Obs)	3 (No. Obs)	4 (No. Obs)	5 (No. Obs)	6 (No. Obs)	No. of Cases
12	MOS	28	.357	1049	3.6	1.3	1052	.364	71.7	.10	0.99	1.02	0.99	1.19	0.91	**	2853
	Local	26	.402		3.0	0.2		.380	75.4	.07	1.10 (2055)	0.77 (541)	0.78 (193)	0.36 (53)	0.45 (11)	* (0)	
18	MOS	30	.378	375	3.9	2.7	380	.310	88.5	.00	0.99	1.12	1.00	0.50	*	*	2846
	Local	36	.293		4.5	2.5		.182	87.6	.00	1.01 (2598)	0.85 (201)	1.17 (35)	0.17 (12)	** (0)	* (0)	

* This category was neither forecast nor observed.
** This category was forecast once but was not observed.

Table 4.1. Definitions of the cloud amount categories used for the local forecasts and observations. The MOS guidance was based on these same categories for opaque amounts only.

Category	Cloud Amount
1	CLR, -SCT -BKN, -OVC, -X
2	SCT
3	BKN
4	OVC, X

Table 4.2. Comparative verification of MOS guidance and local forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 92 stations, 0000 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category				Percent Correct	Skill Score	Number of Cases
		1	2	3	4			
12	MOS	0.78	1.54	1.27	0.79	52.5	.355	13119
	Local	0.88	1.22	1.38	0.83	64.9	.519	
	No. Obs.	5131	2619	1762	3607			
18	MOS	0.74	1.39	1.17	0.71	51.8	.351	13203
	Local	0.73	1.24	1.52	0.63	51.8	.356	
	No. Obs.	3747	3834	2399	3223			
24	MOS	0.85	1.40	1.15	0.66	49.7	.323	13138
	Local	0.82	1.25	1.51	0.62	47.8	.303	
	No. Obs.	3997	3534	2261	3346			

Table 4.3. Same as Table 4.2 except for 24 stations in the Eastern Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
	MOS	0.58	1.76	1.42	0.90	49.2	.311	
12	Local	0.75	1.50	1.56	0.82	59.0	.442	3005
	No. Obs.	993	487	379	1146			
	MOS	0.52	1.29	1.27	0.82	51.6	.336	
18	Local	0.78	1.13	1.45	0.72	50.5	.330	3041
	No. Obs.	501	899	619	1022			
	MOS	0.65	1.66	1.21	0.80	46.4	.280	
24	Local	0.80	1.24	1.62	0.76	45.3	.268	3001
	No. Obs.	844	645	437	1075			

Table 4.4. Same as Table 4.2 except for 24 stations in the Southern Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
	MOS	0.73	1.68	1.19	0.61	50.7	.329	
12	Local	0.89	1.20	1.32	0.78	64.1	.508	3611
	No. Obs.	1411	867	522	811			
	MOS	0.71	1.42	1.09	0.53	53.7	.355	
18	Local	0.73	1.26	1.40	0.44	52.7	.346	3626
	No. Obs.	947	1245	773	661			
	MOS	0.81	1.53	1.07	0.44	50.1	.315	
24	Local	0.80	1.37	1.39	0.39	46.7	.275	3611
	No. Obs.	1087	1094	677	753			

Table 4.5. Same as Table 4.2 except for 28 stations in the Central Region.

Projection (h)	Type of Forecast	Bias by Category				Percent Correct	Skill Score	Number of Cases
		1	2	3	4			
	MOS	0.77	1.46	1.39	0.80	52.1	.353	
12	Local	0.89	1.17	1.35	0.86	65.9	.534	3992
	No. Obs.	1505	799	536	1152			
	MOS	0.70	1.43	1.28	0.70	48.0	.302	
18	Local	0.62	1.35	1.64	0.64	48.3	.313	4028
	No. Obs.	1170	1130	668	1060			
	MOS	0.87	1.30	1.15	0.72	49.5	.320	
24	Local	0.76	1.25	1.46	0.67	47.8	.302	4025
	No. Obs.	1148	1147	700	1030			

Table 4.6. Same as Table 4.2 except for 16 stations in the Western Region.

Projection (h)	Type of Forecast	Bias by Category				Percent Correct	Skill Score	Number of Cases
		1	2	3	4			
	MOS	0.99	1.20	1.00	0.83	59.7	.402	
12	Local	0.95	1.06	1.30	0.88	71.5	.582	2511
	No. Obs.	1222	466	325	498			
	MOS	0.92	1.41	0.95	0.75	55.5	.362	
18	Local	0.84	1.18	1.71	0.67	57.8	.410	2508
	No. Obs.	1129	560	339	480			
	MOS	1.04	1.08	1.22	0.61	53.4	.357	
24	Local	0.91	1.03	1.64	0.55	52.3	.352	2501
	No. Obs.	918	648	447	488			

Table 4.7. Comparative verification of MOS guidance and local forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 92 stations, 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
	MOS	0.91	1.32	1.18	0.65	52.0	.354	
12	Local	0.96	1.06	1.34	0.76	60.8	.474	12845
	No. Obs.	3913	3446	2197	3289			
	MOS	0.91	1.54	1.00	0.83	55.9	.356	
18	Local	0.78	1.60	1.72	0.72	53.6	.347	12717
	No. Obs.	6174	1993	1413	3137			
	MOS	0.92	1.49	1.01	0.75	51.1	.325	
24	Local	0.89	1.37	1.48	0.66	49.8	.316	12827
	No. Obs.	4981	2562	1729	3555			

Table 4.8. Same as Table 4.7 except for 24 stations in the Eastern Region.

Projection (h)	Type of Forecast	Bias by Category				Percent Correct	Skill Score	Number of Cases
		1	2	3	4			
	MOS	0.73	1.59	1.33	0.73	49.3	.323	
12	Local	0.89	1.22	1.45	0.78	56.5	.414	2988
	No. Obs.	857	630	439	1062			
	MOS	0.84	1.72	1.10	0.89	54.0	.346	
18	Local	0.77	1.73	1.71	0.79	53.5	.356	2974
	No. Obs.	1243	381	312	1038			
	MOS	0.80	1.73	1.13	0.83	49.9	.311	
24	Local	0.83	1.56	1.63	0.71	48.4	.302	2977
	No. Obs.	994	462	378	1143			

Table 4.9. Same as Table 4.7 except for 24 stations in the Southern Region.

Projection (h)	Type of Forecast	Bias by Category				Percent Correct	Skill Score	Number of Cases
		1	2	3	4			
	MOS	0.92	1.36	1.06	0.54	52.1	.344	
12	Local	0.96	1.10	1.29	0.66	63.9	.510	3523
	No. Obs.	1079	1060	650	734			
	MOS	0.89	1.70	0.83	0.74	55.3	.324	
18	Local	0.74	1.67	1.63	0.68	51.9	.307	3421
	No. Obs.	1821	606	410	584			
	MOS	0.78	1.70	0.98	0.64	49.5	.307	
24	Local	0.83	1.36	1.52	0.58	48.8	.302	3528
	No. Obs.	1386	845	506	791			

Table 4.10. Same as Table 4.7 except for 28 stations in the Central Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
12	MOS	1.01	1.19	1.12	0.70	50.4	.331	3845
	Local	0.96	1.04	1.31	0.80	58.4	.443	
	No. Obs.	1059	1107	669	1010			
18	MOS	0.94	1.48	1.05	0.83	57.3	.373	3831
	Local	0.76	1.74	1.85	0.71	53.6	.354	
	No. Obs.	1830	556	399	1046			
24	MOS	1.02	1.34	1.01	0.73	49.9	.310	3821
	Local	0.95	1.33	1.39	0.65	49.0	.307	
	No. Obs.	1387	777	527	1130			

Table 4.11. Same as Table 4.7 except for 16 stations in the Western Region.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Percent Correct	Skill Score	Number of Cases
12	MOS	0.94	1.19	1.31	0.57	57.6	.418	2489
	Local	1.04	0.89	1.34	0.76	65.1	.521	
	No. Obs.	918	649	439	483			
18	MOS	0.98	1.23	1.04	0.81	57.1	.348	2491
	Local	0.90	1.24	1.67	0.63	55.8	.348	
	No. Obs.	1280	450	292	469			
24	MOS	1.07	1.12	0.92	0.77	56.5	.344	2501
	Local	0.92	1.25	1.40	0.69	54.0	.331	
	No. Obs.	1214	478	318	491			

Table 5.1. Definitions of the categories used for verification of persistence, local, and guidance forecasts of ceiling height and visibility.

Category	Ceiling (ft)	Visibility (mi)
1	≤ 400	<1
2	500-900	1-2 3/4
3	1000-2900	3-6
4	≥ 3000	>6

Table 5.2. Comparative verification of MOS guidance, persistence, and local ceiling height forecasts for 93 stations, 0000 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Log Score	Percent Correct	Skill Score
12	MOS	1.34	0.68	0.94	1.01	2.372	82.5	.359
	Local	0.69	0.72	1.26	1.00	1.468	87.4	.547
	Persistence	0.76	0.75	0.91	1.03	1.481	87.9	.533
	No. Obs.	458	591	1213	12200			
15	Local	0.43	0.51	1.08	1.02	1.460	83.9	.427
	Persistence	1.67	0.81	0.64	1.05	1.717	83.9	.397
	No. Obs.	210	551	1707	12075			
18	MOS	1.32	0.90	0.76	1.03	1.267	85.2	.372
	Local	0.30	0.46	0.98	1.02	1.136	85.2	.390
	Persistence	3.85	1.49	0.64	1.02	1.770	82.8	.309
	No. Obs.	91	304	1725	12350			
24	MOS	1.16	0.91	0.73	1.02	0.936	90.8	.345
	Local	0.29	0.47	1.67	0.97	0.966	88.2	.321
	Persistence	2.78	2.00	1.31	0.95	1.844	84.3	.199
	No. Obs.	126	223	831	13273			

Table 5.3. Same as Table 5.2 except for visibility, 0000 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category				Log Score	Percent Correct	Skill Score
		1	2	3	4			
	MOS	0.67	2.15	0.86	1.00	2.539	76.1	.372
12	Local	0.62	0.64	1.12	1.00	1.724	81.9	.518
	Persistence	0.58	0.47	0.70	1.10	1.652	83.1	.485
	No. Obs.	492	411	2452	11094			
	Local	0.36	0.45	0.96	1.03	1.304	84.1	.409
15	Persistence	1.94	0.77	0.86	1.02	1.681	82.5	.367
	No. Obs.	150	250	2021	12114			
	MOS	0.33	2.24	0.98	1.00	1.109	86.7	.361
	Local	0.25	0.35	0.80	1.03	0.915	88.5	.360
18	Persistence	3.27	1.52	1.21	0.96	1.654	83.4	.301
	No. Obs.	89	127	1430	12824			
	MOS	0.51	1.86	1.06	0.99	1.114	87.1	.346
	Local	0.28	0.31	0.79	1.03	0.939	88.8	.314
24	Persistence	2.54	1.39	1.39	0.94	1.756	82.7	.251
	No. Obs.	114	142	1242	12951			

Table 5.4. Same as Table 5.2 except for ceiling height for 94 stations, 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category				Log Score	Percent Correct	Skill Score
		1	2	3	4			
	MOS	0.92	0.82	0.81	1.02	0.840	91.3	.385
12	Local	0.52	0.76	1.56	0.97	0.674	91.6	.515
	Persistence	0.70	1.11	1.36	0.98	0.664	92.1	.534
	No. Obs.	122	229	840	13353			
	Local	0.42	0.69	1.61	0.98	0.873	90.2	.444
15	Persistence	0.50	0.93	1.43	0.98	0.935	89.7	.404
	No. Obs.	163	275	806	13435			
	MOS	1.12	0.96	0.83	1.01	1.411	88.2	.362
	Local	0.35	0.79	1.60	0.97	1.204	87.8	.420
18	Persistence	0.34	0.81	1.21	1.00	1.286	87.2	.327
	No. Obs.	255	314	930	12861			
	MOS	1.41	0.80	0.85	1.01	2.554	81.5	.329
	Local	0.37	0.72	1.67	0.97	2.188	80.8	.355
24	Persistence	0.18	0.43	0.94	1.07	2.194	81.4	.211
	No. Obs.	479	591	1204	12161			

Table 5.5. Same as Table 5.2 except for visibility for 94 stations, 1200 GMT cycle.

Projection (h)	Type of Forecast	Bias by Category 1	2	3	4	Log Score	Percent Correct	Skill Score
12	MOS	0.40	1.70	0.98	1.00	1.021	88.1	.382
	Local	0.41	0.57	1.08	1.00	0.686	91.7	.560
	Persistence	0.61	0.89	1.00	1.00	0.666	92.6	.607
	No. Obs.	109	145	1270	13012			
15	Local	0.58	0.71	1.16	0.99	0.817	89.8	.473
	Persistence	0.71	1.02	0.99	1.00	0.810	90.6	.489
	No. Obs.	90	129	1281	13172			
18	MOS	1.19	1.71	0.84	1.01	1.308	86.7	.371
	Local	0.55	0.95	1.25	0.98	1.168	86.4	.410
	Persistence	0.46	0.82	0.88	1.02	1.080	88.1	.403
	No. Obs.	148	161	1412	12634			
24	MOS	0.90	1.98	0.87	1.00	2.764	75.6	.372
	Local	0.38	0.80	1.14	1.00	2.416	76.5	.378
	Persistence	0.13	0.30	0.51	1.18	2.430	77.2	.232
	No. Obs.	506	432	2442	11038			

Table 6.1. Verification of MOS guidance and local max/min temperature forecasts for 93 stations, 0000 GMT cycle.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Today's Max	MOS		1.1	3.1	2.8	--	--
	Local	14597	0.7	2.9	2.2	--	--
Tonight's Min	MOS		-0.8	3.3	2.0	0.40	0.66
	Local	14598	-0.4	3.1	1.6	0.34	0.55
Tomorrow's Max	MOS		0.7	3.8	4.9	--	--
	Local	14571	0.6	3.7	4.7	--	--
Tomorrow Night's Min	MOS		-1.1	3.9	4.6	0.35	0.73
	Local	14564	-0.8	3.8	4.0	0.30	0.64

Table 6.2. Same as Table 6.1 except for 24 stations in the Eastern Region.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Today's	MOS		1.1	3.3	3.3	--	--
Max	Local	3352	0.8	3.1	3.1	--	--
Tonight's	MOS		-0.7	3.2	2.0	0.18	0.86
Min	Local	3373	-0.1	3.0	1.6	0.12	0.83
Tomorrow's	MOS		1.0	3.9	5.0	--	--
Max	Local	3335	0.8	3.8	4.9	--	--
Tomorrow	MOS		-1.0	3.8	3.7	0.25	0.83
Night's Min	Local	3362	-0.6	3.7	3.4	0.25	0.78

Table 6.3. Same as Table 6.1 except for 24 stations in the Southern Region.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Today's	MOS		1.2	2.8	2.0	--	--
Max	Local	3951	0.8	2.5	1.6	--	--
Tonight's	MOS		-0.0	2.9	1.3	0.00	*
Min	Local	3939	0.1	2.8	0.9	0.00	*
Tomorrow's	MOS		0.6	3.2	3.0	--	--
Max	Local	3953	0.8	3.1	3.1	--	--
Tomorrow	MOS		-0.2	3.4	2.8	0.00	*
Night's Min	Local	3928	-0.1	3.4	3.1	0.00	*

*No forecasts of $\leq$32°F were made.

Table 6.4. Same as Table 6.1 except for 28 stations in the Central Region.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Today's	MOS		1.0	3.3	3.1	--	--
Max	Local	4553	0.6	3.1	2.4	--	--
Tonight's	MOS		-0.9	3.5	2.1	0.47	0.56
Min	Local	4550	-0.2	3.3	1.3	0.37	0.42
Tomorrow's	MOS		0.7	4.0	5.9	--	--
Max	Local	4545	0.6	4.0	5.6	--	--
Tomorrow	MOS		-1.1	4.3	5.8	0.37	0.69
Night's Min	Local	4542	-0.7	4.2	4.7	0.27	0.53

Table 6.5. Same as Table 6.1 except for 17 stations in the Western Region.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Today's	MOS		1.0	3.1	2.8	--	--
Max	Local	2741	0.4	2.8	2.0	--	--
Tonight's	MOS		-2.1	3.6	2.8	0.56	0.61
Min	Local	2736	-1.6	3.4	2.6	0.56	0.50
Tomorrow's	MOS		0.6	4.1	5.8	--	--
Max	Local	2738	0.2	3.8	5.4	--	--
Tomorrow	MOS		-2.6	4.2	5.8	0.47	0.69
Night's Min	Local	2732	-2.1	4.0	4.9	0.47	0.60

Table 6.6. Verification of MOS guidance and local max/min temperature forecasts for 93 stations, 1200 GMT cycle.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Tonight's	MOS		-1.1	3.1	1.2	0.50	0.58
Min	Local	14536	-0.7	2.8	1.1	0.45	0.48
Tomorrow's	MOS		1.1	3.7	4.7	--	--
Max	Local	14539	0.6	3.4	3.8	--	--
Tomorrow	MOS		-0.9	3.7	3.1	0.36	0.76
Night's Min	Local	14548	-0.6	3.5	2.6	0.30	0.67
Day After	MOS		1.2	4.3	7.2	--	--
Tomorrow's Max	Local	14486	1.0	4.1	6.8	--	--

Table 6.7. Same as Table 6.6 except for 24 stations in the Eastern Region.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Tonight's Min	MOS		-0.9	2.9	0.9	0.25	0.79
	Local	3332	-0.5	2.8	1.2	0.25	0.69
Tomorrow's Max	MOS		1.3	3.8	5.2	--	--
	Local	3316	0.8	3.6	4.6	--	--
Tomorrow Night's Min	MOS		-0.9	3.6	2.5	0.21	0.90
	Local	3335	-0.4	3.4	2.2	0.29	0.79
Day After Tomorrow's Max	MOS		1.5	4.3	6.9	--	--
	Local	3290	1.3	4.2	7.1	--	--

Table 6.8. Same as Table 6.6 except for 24 stations in the Southern Region.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Tonight's Min	MOS		-0.5	2.7	0.6	0.00	*
	Local	3898	-0.4	2.5	0.6	0.00	1.00
Tomorrow's Max	MOS		0.8	3.2	3.3	--	--
	Local	3912	0.6	2.8	2.1	--	--
Tomorrow Night's Min	MOS		-0.2	3.3	2.5	0.00	1.00
	Local	3901	-0.1	3.1	2.2	0.25	0.50
Day After Tomorrow's Max	MOS		0.6	3.6	4.7	--	--
	Local	3906	0.8	3.5	4.4	--	--

*No forecasts of $\leq$32°F were made.

Table 6.9. Same as Table 6.6 except for 28 stations in the Central Region.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Tonight's Min	MOS		-1.2	3.3	1.4	0.63	0.53
	Local	4574	-0.6	3.0	0.9	0.50	0.40
Tomorrow's Max	MOS		1.3	3.9	5.6	--	--
	Local	4571	0.6	3.6	4.3	--	--
Tomorrow Night's Min	MOS		-0.8	4.0	3.6	0.41	0.74
	Local	4575	-0.3	3.8	2.7	0.25	0.65
Day After Tomorrow's Max	MOS		1.4	4.6	8.7	--	--
	Local	4568	1.1	4.5	8.6	--	--

Table 6.10. Same as Table 6.6 except for 17 stations in the Western Region.

Forecast Projection	Forecast Type	Number of Cases	Mean Algebraic Error (°F)	Mean Absolute Error (°F)	Percent of Absolute Errors >10°F	Probability of Detection (32°F)	False Alarm Ratio (32°F)
Tonight's Min	MOS		-2.3	3.6	2.3	0.60	0.47
	Local	2732	-1.7	3.3	1.9	0.67	0.41
Tomorrow's Max	MOS		1.1	3.8	4.5	--	--
	Local	2740	0.3	3.4	4.1	--	--
Tomorrow Night's Min	MOS		-2.2	3.9	4.0	0.50	0.62
	Local	2737	-1.9	3.7	3.6	0.44	0.56
Day After Tomorrow's Max	MOS		1.3	4.6	8.5	--	--
	Local	2722	0.5	4.3	7.3	--	--